

MANUEL GARCIA'S CONTRIBUTION TO LARYNGOLOGY*

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ANY outstanding and valuable discoveries in the field of science have reached completion gradually. It has been stated that "necessity is the mother of invention". Necessity is an important stimulus to industry and also is an excellent teacher. Attempts to overcome difficulties and to solve problems have been made by thoughtful minds at different epochs throughout man's existence. Too often, however, failure to overcome apparently insurmountable difficulties has led to abandonment of a project when perseverance would have been rewarding. An unsuccessful attempt need not be considered a complete failure for another's efforts may supply to an idea, which was considered barren, a meaning which the world is ready to accept. The light that revealed the larynx had smoldered for half a century before Manuel Garcia reflected the sun's rays to reveal the hitherto darkened chambers of this organ.

Let us consider the practice of laryngology before Garcia's contribution to this field and review the inventions and adaptations of previously employed methods by his predecessors. In 1837, Trousseau and Belloc won the prize of the Paris Academy of Medicine for their work on laryngeal phthisis. The treatment employed consisted of injecting blindly a solution of silver nitrate, through a curved cannula passed behind the epiglottis. The larynx had not been observed either before or after the treatment. Since tuberculosis and syphilis were considered the causes of practically all cases of aphonia and dysphonia, a diagnosis was comparatively easy. The treatment was the same for both conditions.

During 1835, Horace Green who had moved from Rutland, Vermont, to New York City, spent several months in Europe. In a casual conversation with Dr. James Johnson, editor of the *British and Foreign Medical Review*, the difficulty and uncertainty which attended the

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treatment of laryngeal disease were discussed. Dr. Johnson stated that all modes of treatment would fail, until appropriate therapeutic agents could be applied directly to the lining membrane of the larynx. This remark made a profound impression on the mind of Dr. Green, still a young man, and suggested the idea of medicating the cavity of the larynx by catheterization. Upon his return to New York City he devised a probang to introduce a solution of silver nitrate into the larynx. He first met with difficulty but becoming more expert he was able to catheterize both larynx and bronchi. He reported the results before the Medical and Surgical Society of New York in 1840 and published a "Treatise on Diseases of the Air Passages" in 1846.¹ It must be remembered that all his work was done without laryngoscopic aid. His report aroused bitter opposition and his claims were condemned as "an anatomical impossibility and an unwarrantable innovation in practical medicine." This opinion was supported by a professor of anatomy. Dr. Green was requested to withdraw from membership in the Society.

Since neither he nor his colleagues had seen the larynx in the living, one can appreciate their reaction to his claims. In addition, opposition arose from the fact that Dr. Green had a large practice and had carved out for himself a specialty when this was considered questionable from an ethical viewpoint, particularly as it applied to laryngology. Green later vindicated himself by passing a probang through the larynx of a man, who had a tracheostomy and demonstrated to a group of physicians the distal end of the instrument opposite the opening in the trachea.

There was no reference in his writings to the problem of inspecting the larynx either for purposes of diagnosis or treatment. His ability to apply directly to the laryngeal membranes certain therapeutic agents seemed to have solved adequately the entire problem, either from a diagnostic or therapeutic standpoint. Dr. Green is considered as the pioneer laryngologist in the United States. He had visited European clinics and was familiar with the work of Trousseau in laryngeal phthisis. He had visited England six years after Babington had presented his glottiscope to the Hunterian Society. There was no reference to laryngoscopy in his publication and one must conclude that this diagnostic aid was not practiced by him and probably was unknown to him.

Let us now turn briefly to the development of methods of indirect laryngoscopy. Tubes and specula for inspection of external canals of the body are of ancient origin (Pompeii). The dentist's mirror seems

to have been employed from time immemorial, for it was used in the Augustan age. The sun everywhere served as an illuminant. Reflected light was introduced in 1743 by Levret of Paris, who inserted a mirror of polished steel to aid him in placing ligatures around nasal polyps to be removed by constriction. In 1789, Archibald Cleland, an English Army surgeon, described an apparatus bearing a candle and a biconvex lens "to dart the collected rays of light into the bottom of the ear, or the bottom of any cavity that can be brought into a strait line."

In 1807, a report was published by Dr. Philip Bozzini on a light conductor for the illumination of the internal cavities and spaces in the living animal body. It consisted of a source of light, a candle, two hollow tubes or specula, each equipped with a mirror, one to reflect the light and the other to receive the image. While the requisites for making a laryngoscopic examination were fully appreciated by Bozzini, namely: "if a person wishes to see around a corner . . . the rays must be broken and a mirror is required for illumination and reflexion." This ingenious apparatus was complicated, not easy of application and soon fell into oblivion. Its size alone seriously impaired its usefulness for inspection of the larynx since it was 13 inches long and 3 inches wide. Bozzini must be credited with recognizing the principles of indirect laryngoscopy, but he failed to construct an appropriate apparatus that was fitted for the purposes of the art.

In 1825, a French physiologist, Cagniard de la Tour made an unsuccessful attempt to examine the larynx by introducing a small mirror to the back of the throat, hoping with the aid of sunlight reflected by a second mirror to see the larynx. He could see the epiglottis, but imperfectly. Had he persevered with this method the name of Garcia might not have attained such distinction as it now enjoys in laryngology.

In 1827, Dr. Senn of Geneva attempted mirror laryngoscopy in the case of a little girl but failed probably because he employed no illumination. In his remarks he expressed the opinion that "this method could be employed with advantage in the case of adults and, in certain cases of laryngeal phthisis it might assist in diagnosis."

In 1829, Benjamin Guy Babington, presented before the Hunterian Society of London, his "glottiscope," an oblong mirror attached to a long shank and a tongue depressor which was united to this by a simple mechanism. With the patient seated, back to the sun, light was reflected on the laryngeal mirror with an ordinary looking glass. Here was a

method which made examination of the larynx possible, although apparently not practicable or easy for it required two hands. It was not an unqualified success for Babington himself abandoned the combination mirror and tongue depressor and used only a mirror similar to that employed today. He did not use artificial light, depending upon sunlight. This may have contributed to its failure of acceptance particularly in London. While he used the glottiscope on many patients he left no record of his results.

Three years later Bennati, of Paris, reported seeing the vocal cords with the aid of two tubes, one to carry light to the larynx and the other to send back the laryngeal image, from a mirror in the distal end. Trousseau, the eminent clinician, who had ordered one for his own use, asserted that it was impossible to see the larynx, because the apparatus set up so much gagging with closure of the throat, that the larynx would have been concealed from view.

Baumes presented a mirror about 3 cm. in diameter before a medical society in Lyons in 1838. He left no record concerning its use, though stating it was of value for examining the larynx.

Two years later, Liston, a Scottish surgeon, used what was probably a dentist's mirror, which was carried well back in the throat. He examined only swellings obstructing the laryngeal orifice and made no attempt to visualize the vocal cords.

During 1844, Warden of Edinburgh reported two successful cases of laryngoscopy by using a tube and two prisms, one for throwing lamplight into a tube and the other at the distal end to cast light upon the glottis. To aid in this examination which evidently was difficult he touched the throat with the finger to quiet its irritability, to depress the tongue, and to dilate the back of the throat, meanwhile encouraging the patient to swallow in order to raise the larynx. To have seen the larynx in two patients by this method is indeed remarkable. Needless to say it never became popular.

At about this time, Avery of London used an apparatus similar to Bozzini's to see the larynx. He employed a single tube with a reflecting mirror at its distal extremity, artificial light and a concave perforated reflector before the examiner's eye, to reflect light into the laryngoscope. The apparatus was clumsy and heavy and the tube was poorly tolerated by the patient.

All of these attempts to devise an apparatus to visualize the vocal

cords were made by physicians who apparently manifested more than the usual interest in the larynx and could well be considered as laryngologists. They wished to see the interior of the larynx so that they might diagnose and intelligently treat diseases of that organ. Although a number reported that they had observed the vocal cords there is no written record of their findings. It is very probable that successful laryngoscopic examinations were isolated and incomplete, largely because of technical difficulties and lack of experience. The methods could not be considered as consistent practical aids and there was lacking conviction that they possessed any merit, even in the minds of those who invented the various instruments.

During this time Manuel Garcia, a singing teacher, also manifested an interest in the larynx but for a different reason. He probably was as familiar with the anatomy of the larynx as any physician of his time for he had dissected it on numerous occasions. He was consumed with a desire to see "a healthy glottis in the very act of singing", so that he might perfect his anatomical and physiological studies. Gratification of this was made possible while he was on vacation and I quote his account: "One September day, in 1854, I was strolling in the Palais Royal, preoccupied with the ever-recurring wish so often repressed as unrealizable, when suddenly I saw the two mirrors of the laryngoscope in their respective positions, as if actually present before my eyes. I went straight to Charriere, the surgical instrument maker, and asked if he happened to possess a small mirror with a long handle, was informed that he had a little dentist's mirror, which had been one of the failures of the London Exhibition of 1851. I bought it for six francs. Having obtained also a hand mirror, I returned home at once, very impatient to begin my experiments. I placed against the uvula the little mirror (which I heated in warm water and carefully dried); then, flashing upon the surface with a hand mirror a ray of sunlight, I saw at once to my great joy, the glottis open before me and so fully exposed, that I could perceive a portion of the trachea. When my excitement had somewhat subsided, I began to examine what was passing before my eyes. The manner in which the glottis silently opened and shut, and moved in the act of phonation, filled me with wonder."

Garcia's wish had been gratified. He had seen a living larynx in the act of phonation. Here was a golden opportunity to learn about the physiology of the larynx and to enhance his knowledge of its anatomy.

He had a very tolerant throat and as a singer had learned to keep the base of his tongue down. He began to perform autolaryngoscopy making observations on his own larynx during phonation and singing. It is interesting to note that Garcia was the first to conceive the idea of autoscopic examination. He became proficient with the mirror and soon studied the larynges of other singers. Both hands were required to manipulate the mirrors and therefore the examiner could not hold the tongue. No one had enlisted the patient to provide this important aid. Garcia admitted that he could not see the anterior end of the glottis, but being interested only in singing this did not detract from his observations. Up to this time the mechanism of voice production was not too well understood, for no one ever had obtained a satisfactory view of the larynx in action. Experiments on animals and comparison of the larynx with various musical instruments had formed the basis of views then held. Needless to say these were not harmonious.

Garcia presented a paper on "Observations on the Human Voice" before the Royal Society of London on May 24, 1855.² He explained "that tones are elicited when the stream of expired air is divided into a series of uniformly recurring blasts," which he called explosions, by the regular vibrations of the vocal cords. The closed cords are pushed apart by the escaping air, but because of their elasticity they immediately come together again. When they are in close apposition the tones are pure or brilliant; when contact is incomplete the tones are veiled. He recounted how the different registers, chest, falsetto, and head tones, are entirely determined by the shape of the cords and the extent to which they vibrate; and how the "breaking" of a boy's voice as he approaches puberty is due to their elongation, consequent upon a growth of the laryngeal cartilages that produces the prominent "Adam's apple". Garcia was the first to make and describe these observations.

His achievement was arrived at independently and represented the fruition of his "ever-recurring wish so often repressed as unrealizable." Garcia proved to be an exception to Homer's sentiment:

"By mutual confidence and mutual aid
Great deeds are done and discoveries made;
The wise new prudence from the wise acquire,
And one great hero fans another's fire."

Did Garcia obtain "mutual confidence" to inspire, and "mutal aid" to guide; did he fan another's fire? There is every reason to believe that

he was unaware of any previous attempts to visualize the larynx or any device or apparatus that had been invented for this purpose. Garcia's profession was not scientific from a medical viewpoint. His work and life had no common bond with the medical fraternity nor was he aware that for fifty years unsuccessful efforts had been made by members of the medical profession to achieve that which he had hoped for and finally did attain. His decision to employ two mirrors apparently was arrived at independently. Had he been familiar with de la Tour's attempts in 1825 to see the larynx by employing two mirrors or with Babington's glottiscope devised four years later, his "unattainable wish" to which he frequently referred might have been realized much earlier.

In 1840, at the age of 35, he had presented before the French Academy of Sciences a paper that was highly commended by that distinguished group and served as a sound basis for subsequent investigation of the voice. Fourteen years elapsed, however, before he was able to compare his inferential observations with those based on seeing the living larynx during the act of phonation.

Garcia's paper in London was received with apathy and shared a fate similar to Babington's contribution. It was believed that the method had a limited application; besides, he was not a member of the medical profession. His studies of the physiology of the larynx apparently escaped notice at that time. Increased interest in his work, however, was revived when a conflict over priority arose in continental Europe. The principals were Türck and Czermak. During the summer of 1857, Dr. Ludwig Türck of Vienna who had read Garcia's paper employed the laryngeal mirror in the wards of the General Hospital. He was not successful and at the end of autumn when there was little sunshine, discontinued his attempts. During November of that same year, Dr. Johann Czermak of Budapest, a physiologist, to whom Türck had shown the method, borrowed the mirror since Türck had discontinued its use. Czermak improved the technique by using artificial light and employing the large ophthalmoscopic mirror of Ruete for concentrating the rays. Mirror laryngoscopy was no longer dependent on the "clock and the barometer". He also changed the awkward hinge which connected the mirror with the handle and mirrors of different sizes were made. He unquestionably created the "art of laryngoscopy."

There can be little doubt that Garcia's contemporaries recognized his great contribution to mirror laryngoscopy and to laryngology, par-

ticularly as it pertained to voice disturbance. The following year, in 1858, when Czermak published his first essay entitled "Physiological Researches with the Laryngeal Mirror of Garcia" he gave Garcia's name to the mirror and commented favorably on his original researches. Dr. George Gibb³ of London in 1863 acknowledged "How much we owe to Garcia and his researches which had given the first impulse to the study of laryngoscopy and had formed the basis of experiments for all subsequent observers."

While it is true that Babington demonstrated the possibility of viewing the interior of the larynx in 1829, he failed to appreciate the significance of his discovery and neither he nor his contemporaries foresaw its potential value in the field of laryngology. De la Tour's observations made four years previously suffered a similar fate. Garcia, working independently and with an entirely different viewpoint was able to see not only his own vocal cords in action, but also made similar studies on many singers. His observations, from a singing teacher's point of view embraced physiology and anatomy. There were no medical implications. The application of his observations for medical purposes was made by Türck in 1857. Türck's enthusiasm may have been cooled by the cloudy weather of autumn for he observed that "he was very far from having any exaggerated hopes about the employment of the laryngeal mirror in practical medicine." Czermak must be credited with perfecting the technique of mirror laryngoscopy and demonstrating its value in diagnosis and treatment.

Czermak's claims precipitated a bitter struggle between himself and Türck regarding priority. This probably was fortuitous as it unquestionably brought the importance of mirror laryngoscopy before the medical profession and both contributed enormously to its popularity.

In 1859, Morell Mackenzie⁴ visited Czermak and became acquainted with laryngoscopy, "whilst the art was still in its cradle." In the summer of 1860, Czermak visited London and through his exertions the fame of laryngoscopy spread over the land and it became as indispensable an instrument in the hands of the profession as was the stethoscope.

The use of mirror laryngoscopy in the United States is of interest and should be recounted. In 1858, Dr. Ernest Krackowizer who was practicing surgery in New York City, received a laryngoscope from Vienna, the first of these instruments to reach the United States. He demonstrated the vocal cords and emphasized the possibilities, but being

a general surgeon had no use for the instrument. Horace Green secured a mirror through Krackowizer and proceeded to use it to its fullest extent. Bryson Delavan stated "he was the first in this country to appreciate its value and to use it clinically."

On March 6, 1861 Wm. H. Church presented a paper on the laryngoscope before The New York Academy of Medicine. In 1864, Louis Elsberg who went abroad following his graduation from Jefferson Medical College in 1857 to study laryngoscopy with Czermak, published a book which included his previously presented papers entitled "Laryngoscopical Medication." Elsberg began courses in Laryngoscopy in 1861. He was not alone to spread the gospel of laryngoscopy in the new world. Within a decade after Garcia's monumental contribution a number of lectureships in laryngoscopy had been established in the leading medical schools of this country. Laryngoscopy already was well established in the old world.

In former times discoverers often were persecuted; in later years they were ignored and their inventions were neglected. Garcia's contribution provoked little interest at the time of its presentation, but within a decade it was generally accepted. He had the satisfaction of living to participate in its golden jubilee; to observe the creation of a new specialty, an important addition to the science of medicine, and to have indirectly given help to millions.

Mr. Chairman, I am very happy to join with you and your colleagues to honor the memory of the distinguished singing teacher, Manuel Garcia, who made the greatest single contribution to laryngology, one hundred years ago.

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